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LORAL
Advanced Distributed Simulation

ADST/LADS-94-W003254

# ZEN REGARD DELIVERY ORDER
# Final Report

## CDRL AOO2

Loral Systems Company
ADST Program Office
Orlando, Florida

7 Jan. 1994

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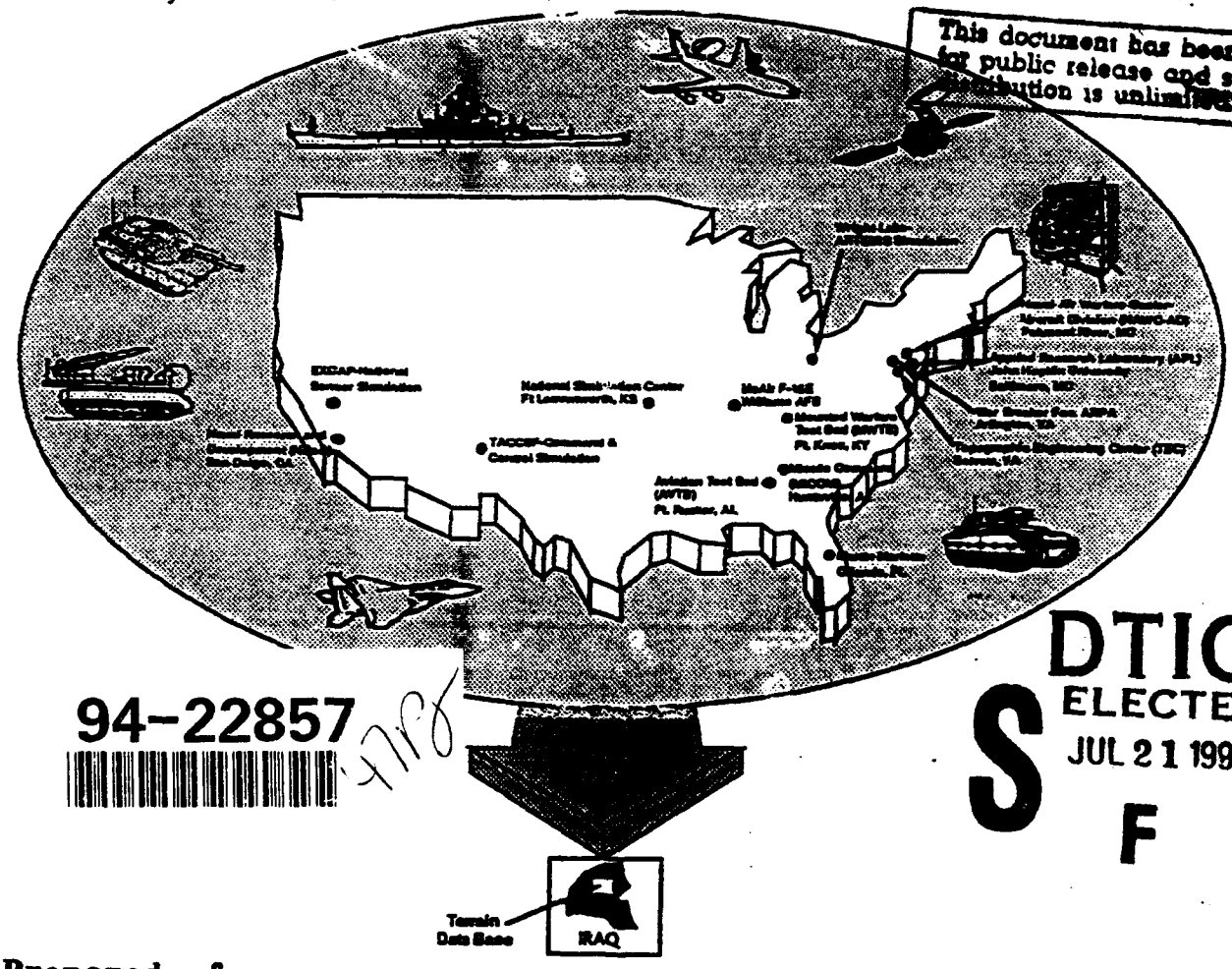


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Prepared for:
STRICOM
Simulation, Training and Instrumentation Command
Naval Training Systems Center
12350 Research Parkway
Orlando, Florida 32826-3275

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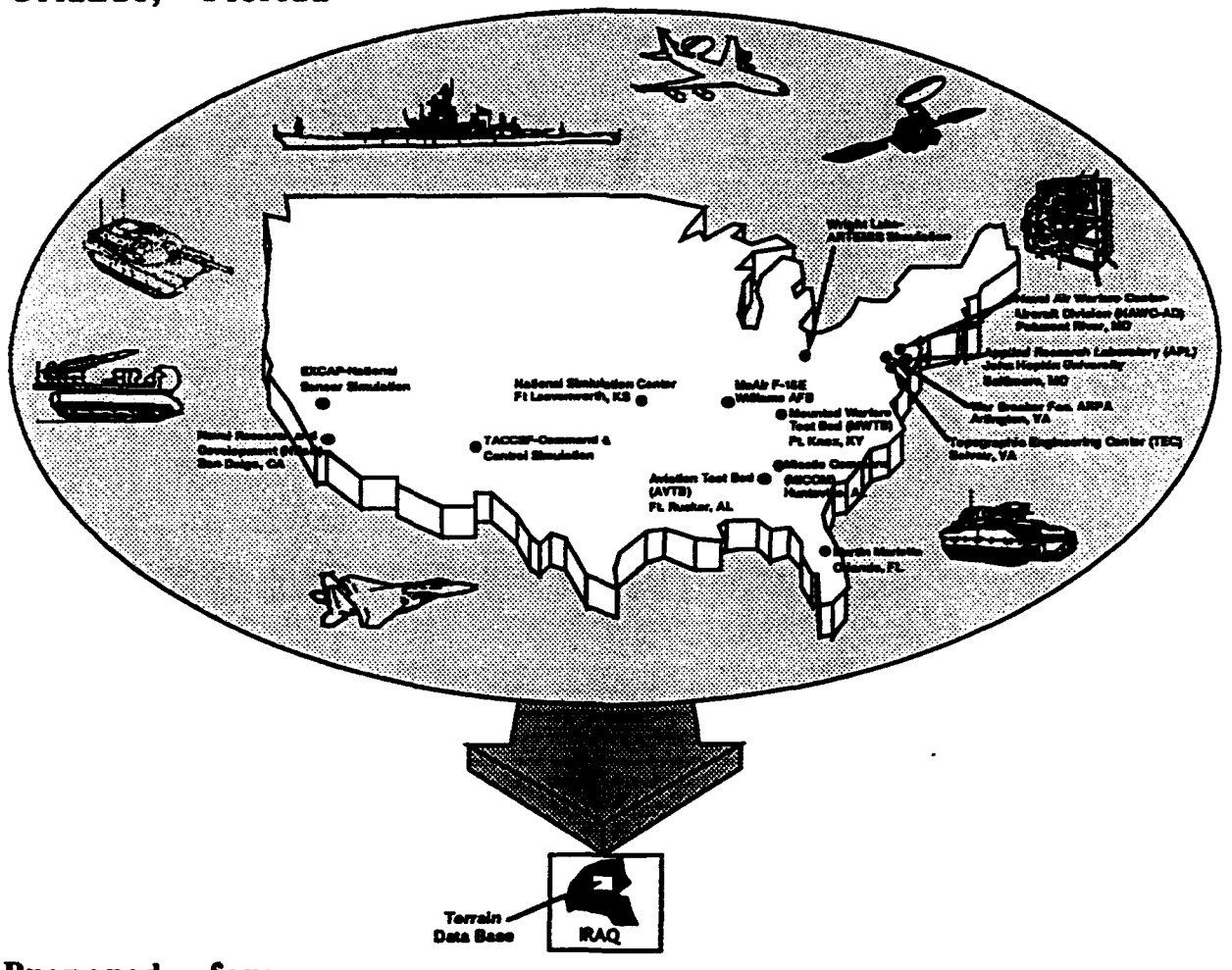


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# 1 INTRODUCTION

## 1.1 PURPOSE

The purpose of the Zen Regard Experiment was to develop and demonstrate the key technologies necessary to support worldwide command and control, surveillance, targeting, attack and bomb damage assessment for future warfighting in the Distributed Interactive Simulation (DIS) Network arena. The Zen Regard Experiment was conducted over approximately 13 locations throughout the United States. The Mounted Warfare Testbed (MWTB) and the Aviation Testbed (AVTB) were the two locations controlled by the Loral ADST Program Office.

## 1.2 BACKGROUND

War Breaker develops and demonstrates capabilities enabling and integrated, end-to-end system that detects, identifies, targets, and neutralizes time-critical targets. The War Breaker program focuses on key on-going ARPA technology developments, augmented with new high leverage Service initiatives and closely coupled with the Precision Stike, Global Surveillance, and Communication Science and Technology thrusts. Although War Breaker is aimed at killing theater ballistic missiles, the enabling technologies are directly applicable to other time-critical targets. ARPA is striving for a fully integrated warfighting system, with system engineering supported by the Distributed Defense Simulation .wargaming environment.

The *Distributed Defense Simulation* wargaming environment combines simulations and simulators capabilities from all branches of the Armed Forces offering the capability of visualizing and communicating system performance, requirements, and man-in-the-loop interactions in an operational context.

## 1.3 FOCUS

The focus of this experiment is on time critical mobile and fixed targets such as tactical ballistic missile launchers, command and control nodes, integrated air defense systems, etc. The following items are some of the major objectives of the Zen Regard Experiment.

- Analyze DIS Simulations capability to support multi-service exercises
- Determine effectiveness of DIS for evaluating the DTLOMS domain
- Establish DIS network for future Modeling and Simulation efforts of current capabilities
- Integrate new and emerging warfighting concepts

# 2 LESSONS LEARNED

## 2.1 MOUNTED WARFARE TESTBED

This section was written directly by the technical participants at the MWTB. Italic comments are additions from the program manager.

A) ISSUE. We need to get into the exercise earlier than we did. All the good testing times were missed. This was mainly due to delays in getting the red gateway and NES equipment devices installed on time.

SOLUTION. Should not be a problems now that the initial setup is complete. One area of concern is that since we do not have a secure area in the building at all times, we cannot run the gateway to keep up with software updates for the gateway and the NES's. These will have to be dealt with if and when we run the exercise again. *Impacts the set-up time for every experiment. The solutions to this is to secure the MWTB as a classified SECRET facility.*

B) ISSUE. We needed to be more involved in the planning of the exercise and attend more meeting in order to understand the big picture a little better.

SOLUTION. More trips to attend IPR's, etc. *Future proposal will include some travel dollars for the technical participant lead for each experiment.*

C) ISSUE. The assistance from NRAD and Warbreaker was pretty good once we found the correct people to talk to. There was still a language barrier concerning what they were seeing and identifying as our vehicles, etc. It was very difficult if not impossible to say who or what was causing the problem. *There was a continuous problem in figuring-out who (what site) was causing the problem.*

SOLUTION. A better defined way for each site to identify vehicles so that we could easily communicate this info between each other. Some of this would also have been eliminated if we had been in the exercise from the beginning. *Longer testing period is needed with a more controlled test procedure.*

D) ISSUE. We need more control at our site to eliminate the amount of data coming in to us. *The simulations at the MWTB could not handle the 1300+ entities that they were seeing on the network.*

SOLUTION. Control of site id's, exercise id's and vehicle id's via a filtering device such as the protocol translator.

E) ISSUE. Our simulators and SAF need to be upgraded to be able to view larger numbers of vehicles easier.

SOLUTION. Software and CIG upgrades. *This entails the purchase of new hard drives and memory.*

F) ISSUE. We need a software package to help identify vehicles, etc. in several different forms. *There are so many different version and types of vehicles that have been added to the various sites, other sites have not been able to keep track.*

SOLUTION. Software development. *Update Ft. Knox vehicle libraries.*

G) ISSUE. We need to have a secure area in the building to eliminate the need for 24 hour guards and make it easier on us to establish the area for testing.

SOLUTION. Develop secure area. *Same as Issue A.*

## 2.2 AVIATION TESTBED

This section was written directly by the technical participants at the AVTB.

The Aviation Test Bed at Ft. Rucker, Alabama participated in the Zen Regard test and demonstration from 1-10 Nov. 93. From a networking and interoperability standpoint, the exercise did not achieve its objectives. The AVTB did not effectively or meaningfully participate in the exercise due to many technological limitations. Below is an explanation of those limitations, their effect on AVTB conduct of the exercise and recommended solutions for each. The AVTB staff will take action/coordinate to correct these deficiencies.

A) ISSUE. Floating or Subterranean targets.

DISCUSSION. When seen at all, vehicles generated for the Zen Regard exercise were shown either as 150 meters below the terrain surface or floating 50 meters above the ground. Entities for the exercise were generated by the Theater Air Command and Control Simulation Facility (TACCSF) and routed through NRaD for SIMNET conversion for the AVTB. Thus there were two points of failure, neither of which were under the control of the AVTB. This problem was either cause by TACCSF's use of an older release of the terrain data base or the poor adjustment of the protocol translator, or a combination of both.

RECOMMENDATION. All participants must use the most current common data bases. Use the on site DIS 2.03 translator in the AVTB facility to allow local adjustments of target height and orientation.

B) ISSUE. Flashing Targets.

DISCUSSION. Throughout the exercise threat vehicles would appear and disappear. This is thought to be caused by the slow update rate forced on the many entities by the constrictions produced by Network Encryption Systems (NES) and protocol translators. Besides the poor visual representation of vehicles, the result of this flashing was an inability to effectively engage targets with Hellfire missiles as the target would frequently disappear prior to missile impact. The target would reappear seconds later, too late for an effective engagement.

RECOMMENDATION. Two options. One is to decrease the number of threat clutter vehicles, thereby increasing available bandwidth and allowing more frequent entity updates. The other is to generate all entities for targeting by one machine and allow the machine to update as frequently as required (5 seconds for SIMNET), and give low update priority to separately generated clutter so they drop out first.

C) ISSUE. Sensor range on Apache simulators initially limited to 3.5 kilometers.

DISCUSSION. The expanded Saudi Arabia - Kuwait - Iraq (SAKI) terrain data base is so large it requires additional memory to generate the out the window (OTW) and FLIR/DTV view. All available memory was used to produce the OTW scene, which left the sensor view restricted to 3.5 km. This is unsuitable for attack helicopter operations. A redistribution of installed memory solved the sensor limit problem. However, the solution resulted in the "downing" of the other 6 CIG's on site for the duration of the exercise.

RECOMMENDATION. STRICOM authorize AVTB to purchase required additional memory for all 12 CIGs on site.

D) ISSUE. Inaccurate target icons.

DISCUSSION. During the exercise SCUD transporter erector launchers would appear to air crews as 5 ton trucks and SA-13's as M-113's. This is because the AVTB does not have the required memory and texture PROM chips to process the large vehicle description files. The electronic Dynamics Effects Database file (DED) contains the description of each vehicle's appearance and characteristics. This file is centrally built and distributed to participants through the War Breaker systems engineering team. For each exercise, a DED file is built and distributed. A central library of DED files that would allow local construction of locally required vehicles files would provide flexibility to each site according to its capabilities.

RECOMMENDATION: Ensure AVTB has the most current DED files on hand and loaded prior to the exercise. Purchase additional memory and texture PROMs as required to process and display the icons vital to proper exercise execution. STRICOM sponsor the development of a master DED library to facilitate the build of flexible DED files for specific exercises.

E) ISSUE. Invisible solid "walls in space" on the terrain data base.

DISCUSSION. During the execution of the mission, aircraft would randomly and without warning crash in mid-air. The aircraft would be reset to rejoin the flight at the next ACP. This was caused by abnormalities in the terrain data base. The data base is built by the Topographic Engineering Center in Ft. Belvoir.

RECOMMENDATION. TEC recompile the SAKI terrain data base and provide to AVTB as soon as possible for testing.

F) ISSUE. Lack of management, command and control (MCC) system control of the simulation.

DISCUSSION. The MCC is a system which provides functions such as initialization, rearm, refuel, close air support, fire support and assignment of aircraft ID numbers. This deficiency restricted local control of JSEAD, FARP use, and greatly complicated the commander's ability to rapidly identify aircraft. This was caused by the lack of a terrain data base specifically compiled for the Masscomp computer which controls MCC functions.

RECOMMENDATION. TEC create the expanded SAKI database for use on the Masscomp computer.

G) ISSUE. Limited munitions available for use by AH-64.

DISCUSSION. Air crews could not use Hydra rockets loaded with MPSM warheads. This limitation is due to the fragility of the War Breaker network. The multiple explosions created by submunition impact saturated the network and were not handled by the very busy protocol converter at NRaD. Each trigger pull causes 18 explosions, and when an aircraft salvos or multiple aircraft fire, saturation happens quickly. this is not a problem that can be fixed near term, as it is a basic architecture problem with dissimilar simulator networking.

RECOMMENDATION. Limit weapon load to 16 Hellfire or 8 Hellfire and 10 pound warheads.

H) ISSUE. The target would show no effect and reappear when hit by hellfire missiles.

DISCUSSION. The firing Apache would see missile impact but no effect. This is a basic problem in networking dissimilar simulations. Each target is responsible for registering impact and damage, then broadcasting results. If the target does not recognize the type round or it's capabilities, no effect will be broadcast or seen by firing unit. The human operator can manually destroy the target if he views the engagement.

RECOMMENDATION. War Breaker system engineering team coordinate and schedule more robust testing in order to confirm and adjust target effects.

I) ISSUE. Filtering of targets at NRaD.

DISCUSSION. The great number of entities generated as both clutter and targets overwhelmed the Semi Automated Force system operating at Ft. Knox. The Knox system would shut down upon entering the populated network because they were producing a large number of entities themselves. To alleviate this problem I agreed that NRaD should filter out the clutter so that only the target entities were broadcast to AVTB and Knox. However all entities were filtered the following day with the results that AVTB saw no other participants. The AVTB was forced to generate targets, thereby negating the effectiveness of distributed simulation. The filtering of targets to satisfy this one deficient node effectively nullified all participation by the AVTB, with the resultant waste of time, money and manpower.

RECOMMENDATION. Four solutions possible. First is to decrease the number of entities generated by Ft. Knox, thereby increasing the number of externally generated entities both they and the AVTB can see. Second is to filter out the clutter entities, so that only target vehicles are broadcast to Knox and the AVTB. Third is to alter network architecture so that operations at the AVTB are independent of those at Ft. Knox. Last would be to eliminate Ft. Knox from further War Breaker participation, as the armored force has no role in the prosecution of time critical mobile targets, and their participation limits the effectiveness of the AVTB, representing a viable strike force.

J) ISSUE. Insufficient testing of War Breaker network architecture.

DISCUSSION. The AVTB was not part of any large scale network loading tests to identify load based problems. Numerous problems first discovered on 1 November should have been identified and resolved prior to STARTEX. The network test schedule was insufficient and assumed schedule flexibility for the AVTB that does not exist. The AVTB built its schedule around the identified network periods, precluding last minute connectivity test requests.

RECOMMENDATION. War Breaker planning group must plan for and adhere to a robust testing schedule that shakes out potential problems and verifies solutions before the beginning of the next exercise.

K) ISSUE. Lack of security classification guide, DD 254, Zen Regard.

DISCUSSION. Although deemed a "Secret/NOFORN" exercise, the agency at War Breaker responsible for security did not and has not published the required DD 254. This document outlines for the contractor what information is classified and how to protect it. Throughout the exercise the AVTB contractor was forced to treat everything as Secret information. This was the only way to ensure no compromise was possible. This both complicated daily operations and put the AVTB at risk. Loral agreed to process, store and issue presumed classified data, although such actions without guidance is contrary to the industrial security standards.

RECOMMENDATION. War Breaker security group approve and publish DD 254 immediately.

# APPENDIX A BDM LESSONS LEARNED REPORT

# WarBreaker Zen Regard Lessons Learned

The following issue and discussion items pertain to the portion of the WarBreaker Zen Regard exercise recently conducted in the Mounted Warfare Test Bed (MWTB) and at the Aviation Test Bed (AVTB). These lessons learned are intended to provide insight into difficulties encountered during the project and should be evaluated prior to the next iteration of exercises involving multi-site operations and exercises involving large data bases. Contributors to this list for MWTB were Mr. Rick Lozicki of BDM Federal, Inc., and Mr. Jimmy Adams of LTTS; input for AVTB observations was obtained from Mr. Bill Parson of BDM Federal, Inc.

1. Site Equipment Problems.

1.1. Issue: There was a lack of equipment available for the MWTB Exercise Control Officer, thereby limiting his effectiveness.

1.1.1 Discussion: Only two SGI platforms were in the operations cell running SAFOR. The Exercise Control Officer was required to view the battlefield by looking at a SAFOR screen while also trying to monitor the Stealth view.

1.1.2. Discussion: The need to use the SAFOR systems to position and attach the Stealth often precluded the Exercise Control Officer from processing information from units. The Exercise Control Officer therefore had to wait until he could gain access to a SAFOR terminal in order to deal with incoming information from the vehicle commanders.

1.2 Issue: The MWTB SAFOR systems often crashed during the conduct of the exercises.

1.2.1 Discussion: The current SAFOR systems cannot handle the amount of information being sent over the net during the exercises. The MWTB needs the ability to filter out sites from the network which are not necessary for the accomplishment of the mission. The protocol translator and other associated equipment should be used before the start of an exercise to check out all system elements.

1.3 Issue: The Stealth vehicle and simulators were unable to see vehicles that were actually within 200 meters of them.

1.3.1 Discussion: The CIGs running the Stealth vehicle and simulators could not process the amount of data gathered during the exercise. Upgrades or new versions of the CIGs are needed to allow a greater data collection capacity.

1.4 Issue: Vehicles generated by other sites appeared on the SGI SAFOR screens but could not be seen by the MWTB Stealth vehicle.

1.4.1 Discussion: Many of the vehicles (both ground and air elements) appeared on the SAFOR screens, but when attached to, could not be found. The SAFOR could describe them as friendly or enemy but

could not identify their model or type. A software upgrade is needed to allow any entity generated by another site to be viewed and identified.

1.5 Issue: Some of the newly developed software for MWTB was inoperable.

1.5.1 Discussion: For this exercise, a new terrain database was developed for the Management Command and Control (MCC) system to place the two M2's and two M1's in their locations. The same MCC is also used to place artillery and engineer elements for producing the requested artillery fires and minefields. We were able to place simulators only; the system would not allow the placement of artillery or engineer assets into the exercise.

1.6 Issue: Placing MWTB simulators via the SIMNET Control Console (SCC) was difficult if the MWTB was on the network at the time.

1.6.1 Discussion: A simulator's parameters entered into the SCC (starting grid location, ammo load, etc.) became altered when the simulator was subsequently placed. Simulators should be placed before any network traffic begins or with the Gateway disconnected. Once the vehicles are set, the Gateway should then be connected.

1.7 Issue. AVTB Memory Capacity.

1.7.1 Discussion. The expanded SAKI terrain data base is large and requires significant memory to generate the out-the-window (OTW) and Forward Looking Infrared Radar/ Day Television View (FLIR/DTV) views required for AVTB aerial vehicles. Since all available memory was allocated to OTW mapping, the sensor views for the AH-64 were limited to 3.5 km, which is unsuitable for Attack Helicopter operations. A temporary fix to installed memory was instituted locally by downing 6 other on-site CIGS.

2. Inter-site Issues

2.1 Issue: Coordination of vehicle visibility across sites.

2.1.1 Discussion: Neither MWTB nor AVTB could see the elements from the other site. Since no one knew who was supposed to see who on the network, it was hard to determine whether or not everything was working.

2.1.2 Discussion: MWTB received word from WarBreaker Headquarters that some of the M3s that put out looked like "blobs" to them. The also reported that one of the SAFOR M1s appeared similarly; no explanation for this anomaly was determined.

2.1.3 Discussion: WarBreaker Headquarters identified vehicles differently than did MWTB. They used Latitude and Longitude to define locations rather than X, Y coordinates or UTM grids used in SIMNET. A common language for the WarBreaker network needs to be established.

2.1.4 Discussion: Many of the other sites had different or larger terrain databases and their vehicles appeared outside the database used by the MWTB. Every effort needs to be made to have everyone on the same playing field; otherwise, deviations should be explained to all participants.

2.2 Issue. Dissimilar systems problems.

2.2.1 Discussion. Update rates by controlling DIS systems caused computer generated systems at AVTB to blink in and out during crucial times. This resulted in the AH-64 Crew's inability to maintain Hellfire lock on the target all the way to missile impact.

2.2.2 DED files, reflecting appropriate exercise models need to be standardized and disseminated to using sites. Non-standard DED files result in "Beach Ball" clutter and often causes site systems to malfunction/crash.

3. Exercise Operations Problems.

3.1 Issue: Scheduling/Administrative Issues.

3.1.1 Discussion: Equipment scheduled for use during the exercise should be identified as soon as possible and installed prior to the beginning of scheduled exercise testing times. Some of the red long-haul equipment was still being installed when system tests were initiated. This put both MWTB and AVTB behind and did not allow either to catch up. Early installation of the protocol translator and associated equipment would allow time to check things out prior to the start of an exercise. More involvement of the site staffs during the planning stages in order to better understand the requirements and total concepts would also help.

3.3 Issue: Scheduling of soldiers.

3.3.1 Discussion: A better job needs to be done of letting troops know when changes to the exercise schedule occur. Troops did not always get the word when practice runs were canceled. At other times, network problems resulted in soldiers being at the MWTB when the system was down. The responsibility for troop notification needs to be clearly established before exercises, so as to avoid embarrassment to the Government or to the contractor team.

3.2 Issue. Exercise Control.

2.1.1 Discussion. The flow of Communications from higher echelons to respective player cells was inadequate. Threat templating and other IPB requirements were never disseminated from higher to lower echelons. As a result, the utilization of Close Air Support (CAS) and Suppression of Enemy Air Defenses (SEAD) was not introduced or controlled throughout the programmed mission.

3.3 Issue. Inadequate scenario preparation.

2.3.1 Discussion. To ensure continuity that the AH-64's were able to achieve realistic targeting in the designated engagement areas, appropriate targets had to be self-generated by AVTB. This was performed with NRaD's authorization.

3.4 Issue: Securing the MWTB

3.3.1 Discussion: A secure area needs to be established in the MWTB to eliminate the need for 24-hour guards and all other requirements necessary to establish and conduct a classified exercise.

4. Pre-Exercise Testing

4.1 Issue. Disparities in terrain data bases. Initial and on-going connectivity testing was inadequate considering the magnitude of the effort. Examples of the resulting difficulties include the following:

4.1.1. Discussion. Virtually all testing between NRaD and AVTB was conducted on the NWIRAQ Terrain data base. Although several attempts were made to determine which terrain data base would be utilized for the demonstration, this was not disclosed until late in the process. Compounding the problem was the fact that, while all of the connectivity testing was done using NWIRAQ, the actual experiment/demo was conducted entirely on the SAKI terrain data base. Many of the problems associated with the SAKI terrain data base, such as "Walls in Space", Terrain clamping, and unaligned terrain intervals, to name a few, could have been identified, and perhaps corrected prior to exercise execution, had that data base been used during the testing.

4.1.2. Discussion. Designated systems proposed by the Zen Regard Playbook should have been employed and fully tested for compatibility during the connectivity phase. AVTB was only permitted to test a single AH-64 against a few selected systems in lieu of the full playbook contingent.

4.1.3. Discussion. Problems associated with TACCSF generated vehicles appearing either 150 meters below the terrain, or floating 50 meters above the ground adversely affected program objectives. Although efforts were initiated to rectify the problem with TACCSF, their vehicles never achieved the proper terrain clamping profile. When floating TACCSF systems were engaged by Hellfire missiles, visual destruction could not be ascertained as a result of this problem. It should be noted that similar problems between MWTB and AVTB were encountered in the recent NLOS-CA Experiment due to disparities in the two terrain data bases.

4.1.4. Discussion. All designated sites should have been incorporated into the connectivity phase to test systems compatibility. Unexplained system crashes caused by the entry of other member sites and their respective models was an on-going problem. This would have been

eliminated, or markedly reduced, with more complete connectivity testing.

4.2 Issue. Technical planning and coordination. Despite pre-conference coordination conferences, details governing site specific "technical" requirements were not adequately formulated nor disseminated to the respective facilities. Examples include:

4.2.1. Discussion. Agreed versions of the Terrain Data Base was not solidified until just prior to the week of presentation;

4.2.2. Discussion. The exercise number for each of the demonstrations was not identified early on.

4.2.3. Discussion. A transcript of the scenarios time lines were not provided to either the Military command group or site technicians for reference and critical cueing.

4.2.4. Discussion. Key supporting members of the supporting contractor community need to be included in appropriate pre-conferences and coordination meetings. Last minute changes and/or attempts to comply with "late breaking" demonstration requirements were too numerous to mention.

# APPENDIX B SITE INTEGRATION TEST PROCEDURES

# War Breaker Site Integration Test Procedures

## DRAFT

October 6, 1993

## INTRODUCTION

The use of these procedures is a start at identifying all of the requirements on simulation applications in order to be involved in the War Breaker DIS exercise. It does not supersede the requirements stated in War Breaker Working Group meetings, etc. This is provided as a reference document, and collection point for details present and future connectivity requirements for DIS exercises. Please feel free to provide input and comments these procedures.

## USAGE OF THESE TEST PROCEDURES:

Note, that all of the tests in this document will not apply to a given simulation application or site.

Some tests contained in this document will not be enforced for the Zen Regard Exercise.

**Results/Annotations:**

- P indicates the System Under Test (SUT) successfully passed/demonstrated a requirement.
- F indicates that the SUT did not perform a test step adequately, and needs to make a change in order to comply with the War Breaker implementation of DIS.
- TBD indicates that a SUT still needs to demonstrate a requirement.
- N/A indicates that a SUT does not need to, does not simulate a requirement

**Recommendations/Comments:**

Please submit recommendations and/or comments to Steve Hansen.

Phone: (703) 908-4420
EMail: shansen@wb.com

**REFERENCES:**

War Breaker Interface Requirements Specification
War Breaker Site Entity Simulation List

1.0 ..... NETWORK LEVEL CONNECTIVITY VERIFICATION
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## System Under Test (SUT) DATA

**Date:**

**Time:**

**Site Name:**

**Site IP Address:**

## 1.0 NETWORK-LEVEL CONNECTIVITY VERIFICATION:

Network level tests are designed to determine the proper compliance with Ethernet version 2.0, UDP/IP, DIS protocol header information.

### 1.1 Bi-directional Communication Tests

Determine if bi-directional communication is established at the network level with the System Under Test (SUT). Use a PING packet originating from the War Breaker Facility (WBF) to determine a good connection. If PING is unavailable, use an appropriate alternative test:

SUT Bi-directional PING test successful. ____

### 1.2 Transmission Test

Determine if the Under Test (SUT) is transmitting Ethernet packets in compliance with Ethernet, UDP/IP, and DIS. Have SUT transmit one or more Entity State (ES) Protocol Data Units (PDU). have the SUT locate a static vehicle at the first of the thirteen test points.

SUT is transmitting Ethernet packets in compliance with Ethernet Version 2, UDP/IP, and DIS. ____

SUT IP address is assigned and used

### 1.3 Reception Test

Determine that the SUT can receive a DIS Entity State (ES) packets. Create an environment at the WBF such that ES PDUs are being transmitted to the SUT.

SUT is receiving DIS packets appropriately. ____

## 2.0 PDU STRUCTURE VERIFICATION

PDU validity tests are designed to test the proper use of each field in the following prioritized DIS PDUs: Entity State (ES), Fire, Detonation (DET), and Emission.

### 2.1 Entity State PDU Compliance

Through the use of PDU inspection tools, indicate PDU data that does not contain appropriate field inform... where appropriate. The SUT will produce values for the below PDUs for entities that the SUT can simul... This test is not the coordinate conversion nor the orientation verification test. This test is primarily used to identify any field that may contain unexpected bad data.

SUT Generates and fills Entity State PDU fields correctly.

**2.2 Fire PDU Compliance** Verify that the SUT can produce DIS compliant Fire PDU... SUT produce a Fire PDU through whatever means necessary. This test is primarily used to ... that may contain unexpected bad data.

SUT Generates and fills Fire PDU fields correctly.

**2.3 Detonation PDU Compliance** Verify that the SUT can produce DIS compliant Detonation P... Have the SUT produce a Detonation PDU through whatever means necessary. This test is primarily used to identify any field that may contain unexpected bad data.

SUT Generates and fills Detonation PDU fields correctly.

**2.4 Emission PDU Compliance** Verify that the SUT can produce DIS compliant Emission P... Have the SUT produce an Emission PDU through whatever means necessary. This test is primarily used ... identify any field that may contain unexpected bad data.

SUT Generates and fills Emission PDU fields correctly
(INDICATE errors below by appropriate element.)

3.0 **Static Tests** SUT will generate traffic on the Network, and the WB facility will verify recep[illegible] correctness of the data in the appropriate fields.

3.1 **Position and Terrain Elevation Comparison Test** Will check coordinate conversions for [illegible] Geodetic, UTM, SIMNET X,Y to DIS coordinate systems, and verify the SUT is able to place and see other vehicles according to DIS standards.

SUT and WB will place Vehicle at the Test Point Locations depending on the entity type. All vehicles will have 0 velocity, and acceleration and be facing true North.

**Ground Elevation Test Setup Points:**

*Note: the elevations should be at ground level at these locations.*

| | DIS packet shows | | SUN conversion (IST derived) | | | |
|---|---|---|---|---|---|---|
| Pt 1: | Geocentric.X = | 3969171.703699 | Latitude = | 34:18:46.08 | or | 34.312800 |
| | Geocentric.Y = | 3472838.583707 | Longitude = | 41:11:03.08 | or | 41.184399 |
| | Geocentric.Z = | 3575301.503150 | Altitude = | 252.981186 m | | |
| Pt 2: | Geocentric.X = | 3938804.480687 | Latitude = | 33:57:14.77 | or | 33.954103 |
| | Geocentric.Y = | 3540809.783785 | Longitude = | 41:57:14.87 | or | 41.954131 |
| | Geocentric.Z = | 3542403.009489 | Altitude = | 318.993835 m | | |
| Pt 3: | Geocentric.X = | 4053555.280644 | Latitude = | 33:32:23.41 | or | [illegible] |
| | Geocentric.Y = | 3448552.042421 | Longitude = | 40:23:21.81 | or | [illegible] |
| | Geocentric.Z = | 3504271.802390 | Altitude = | 459.785461 m | | |
| Pt 4: | Geocentric.X = | 4074719.954666 | Latitude = | 33:40:45.98 | or | [illegible] |
| | Geocentric.Y = | 3410352.347447 | Longitude = | 39:55:39.99 | or | [illegible] |
| | Geocentric.Z = | 3517243.024888 | Altitude = | 594.130005 m | | |
| Pt 5: | Geocentric.X = | 3976964.799880 | Latitude = | 33:48:43.47 | or | 33.812074 |
| | Geocentric.Y = | 3511303.842253 | Longitude = | 41:26:29.83 | or | [illegible] |
| | Geocentric.Z = | 3529378.853102 | Altitude = | 418.00000 m | | |
| Pt 6: | Geocentric.X = | 3908282.201657 | Latitude = | 34:04:11.63 | or | [illegible] |
| | Geocentric.Y = | 3563615.050453 | Longitude = | 42:21:32.06 | or | [illegible] |
| | Geocentric.Z = | 3552958.521979 | Altitude = | 155.115128 m | | |

**Aircraft Test Setup:**

SUT will place aircraft in straight and level flight at 3000 ft above ground level (AGL) starting at location specified by WB facility, with a heading of true north, at its cruise speed. WB will also simulate an aircraft at same location, speed, heading. The two entities will appear at the same altitude, speed, and heading as seen at the visual reference point at the WB facility.

**Water Craft Test Setup:**

SUT will place a water craft at a location determined during the test. The sea state shall be set to [illegible] with a heading of true north, at its cruise speed. WB will shall also simulate a water craft at a determined location near this location, with the same heading, attitude, speed, elevation.

SUT position is located within 1 meter of test point position as reported on WB equipment. ___

SUT attitude is within 0.00005625 radians of WB entity. ___

WB entity is located within 1 meter of test point position as reported on SUT equipment. ___
*(Validation required by/@ remote site.)*

WB entity is at the same level as the SUT. ___
*(Validation required by/@ remote site.)*

**3.2 Scenario Entity Transmission Validation.** The SUT shall generate and transmit entity PDUs for each entity that it shall simulate during the exercise scenario. (See attached IRS Site Entity Simulation List. )

SUT is capable of accepting any War Breaker or other remote site entities that will be simulated in the scenario as detailed below.
*(Use WB Entity Generation File (to be created) or Logged data from previous simulations to generate network traffic of each possible entity from any site.)*

SUT System Performs:

With No System degradation. ___

With Little System degradation. ___

With Some System degradation. ___

With Major System degradation. ___

SUT is correctly able to generate all entities it is scripted to represent for the test scenario according to the description below: (Reference IRS/Scenario Details for list of entities that each site is responsible for simulating).

SUT System Performs:

With No System degradation.

With Little System degradation.

With Some System degradation.

With Major System degradation. ___

Indicate Entities SUT is not capable of simulating:

WB facility is capable to accepting each entity the SUT can generate.

**3.3 Static Network Traffic** SUT shall send Entity State PDU for a period of 1 minute for a unit that is stationary, or is in steady state motion.

Packet rates shall be received from SUT at a rate of 1 per 30 seconds.

**3.4 Appearance/Visual Representation** These tests verify the SUT can correctly and accurately represent entities from a visual standpoint.

The SUT is capable of correctly displaying each entity of within its area of concern and interest for the scenario. (Validation required by/@ remote site.)

**3.5 Articulated Part Validation:** For entities with articulated parts, those parts must be represented in the WB environment, and by those simulations that are capable of displaying articulated parts.

The articulated parts are represented at WB WRM correctly.

WB places an entity with articulated parts in SUT area of simulation.

Articulated parts of WB entity are properly represented/displayed on SUT visual scene (Validation required by/@ remote site.)

**3.6 Entity Time Out**
WB facility shall send an entity to the SUT, and then shall not update the Entity PDU for 73 seconds (IRS Time-out delay is 72 seconds).

SUT shall drop the entity from its simulation after 72 seconds.

**3.7 Static Environment**
WB facility shall set Haze and Cloud Layer(s) - *This capability will not be simulated in Zen Regard*

SUT shall recognize Haze setting

SUT shall recognize Cloud Layer settings

**3.8 Dead Reckoning of Stationary Entities**

SUT DR algorithm is set to 1, (Don't DR me) for stationary entities

**3.9 Static Load Testing**
WB facility will generate network traffic representative of the expected amount of network traffic from sites for static entities (ones that are not moving, or are in steady state motion). 7500 entities transmitting PDU every 30 seconds, plus 500 entities transmitted at 1 PDU per second.

SUT system performance: Does not degrade

Upon destruction, the entity no longer produces emissions (SAM site destruction for example).

SUT entities that are capable of receiving/monitoring emissions are capable of doing so.

4.4.3 Water Craft

Simulated water craft shall be bounded by water - not travel on land.

Water craft shall be situated in the water similar to land vehicles on land, they stay in water.

If water craft attitude is simulated, it will respond to sea state appropriately.

4.4.4 Munitions and Detonation SUT shall fire ordnance that detonates upon impact or by proximity.

The SUT entity is able to fire its weapons.

SUT weapon flyout is in the appropriate direction.

SUT weapon recognizes collision with another entity, or the ground, and detonation &/or termination of the weapon occurs appropriately.

Appearance of fired weapon effects is appropriate (smoke trail, fire etc.).

Upon weapon impact with target entity, terrain, etc.

Weapon detonation occurs according to weapon characteristics.

WB visual scene displays fire/smoke as a result of weapon impact/detonation.

4.4.5 Destruction/Kill of an Entity WB facility shall to shoot to destroy a SUT entity.

Destruction sequence of flames and smoke is observed within 15 seconds.

Appearance of target entity has changed to Black once destroyed.

Simulated Entity State PDU is reduced to 1 per 30 seconds for a period of 10 minutes, and then no longer simulated.

4.4.6 Entity Emissions Sites that are scripted in the scenario as simulating entities with radar emissions, and or receptions must be capable of doing so.

SUT is capable of simulation of emission from entities identified in the Scenario.

Simulated emissions are generated at the appropriate times.

SUT simulated emission generate the correct/appropriate beam azimuth, elevation, center, and sweep.

PDU update rates for emission do not exceed the network budget.

Aircraft:
Altitude changes
Attitude changes
Accelerations/Deceleration's

Clutter Vehicles:
Heading changes due to turns
Altitude changes as a result of terrain elevation
Speed/Stop/Start changes

SUT entity DR update is issued only when:
> 0.9 meters of the estimated position change in any direction occurs
OR Position change of > 5% of overall body length occurs
OR an attitude change > 3 degrees occurs
OR 30 seconds has elapsed since last update.

Average packet rates for SUT shall not be greater than 3 PDUs per second.

SUT entity shall not jitter in the WB visual system.

4.4 Dynamic Entity Movement and Functional Characteristics These tests will verify the functional behavior of simulated objects.

4.4.1 Clutter/Ground Vehicles

SUT Vehicles follow the terrain elevation without going above or below the terrain altitude.

SUT Vehicles follow roads when appropriate.

SUT Clutter Vehicles follow each other in a coordinated turn (When a number are driving down a road they don't turn all at once, but follow each other.

SUT Clutter Vehicles indicate a collision when hitting another object, or a building in the simulation environment.

4.4.2 Aircraft

Simulated aircraft entities shall generate a collision when hitting the ground at excessive velocities.

Aircraft movement shall be representative of actual flight.

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Minor system degradation occurs. ____

Some system degradation occurs. ____

Major system degradation occurs. ____

5.0 INTERACTIVE TESTS These tests verify that the SUT interacts appropriately with the rest simulation sites by generating events or by responding properly to externally generated events.

5.1 Load Testing

SUT is able to simulate the number of entities it is responsible for according to the script of the ZR scenario and system performance (crash, or degrade the simulation fidelity of the entities it is simulating)

Does not degrade ___

Minor system degradation occurs. ___

Some system degradation occurs. ___

Major system degradation occurs. ___

During the simulation of entities that the SUT is responsible for, voice communications performance

Does not degrade ___

Minor system degradation occurs. ___

Some system degradation occurs. ___

Major system degradation occurs. ___

Then SUT is able to receive expected number of simulated entities of the ZR Scenario (8000 entities) and system performance:

Does not degrade ___

Minor system degradation occurs. ___

Some system degradation occurs. ___

Major system degradation occurs. ___

The SUT is able to receive at least 1000 PDUs per second and system performance:

Does not degrade ___

Minor system degradation occurs. ___

Some system degradation occurs. ___

Major system degradation occurs. ___

SUT ignores network traffic with invalid exercise ID's

5.2 **Information Transport Delays** Simulation information being passed between sites must be accomplished without excessive delays.

***Transport delays detailed below will not be tested prior to Zen Regard.***

DIS network to Simulation Application
Protocol Translator
Interface Unit

Simulation Application to DIS Network
Protocol Translator
Interface Unit

Loop back "Ping" Test.

Out of order PDUs.

Dropped PDUs

KG-95 Delay

Network Bridge Delay

5.3 **Intercommunications** SUTs must be capable of communicating with other remote sites -thr- simulating voice radio traffic, support exercise communication with the War Breaker Test Director, as well passing tactical data if the SUT is scripted to perform this function by the scenario.

5.3.1 **Voice Communications**

SUT is able to receive voice communication of all other sites scripted in the Zen Regard Scena...

SUT is able to send voice communications to all other sites in Zen Regard Scenario.

SUT marks its voice communication PDUs with an appropriate Time Stamp.

No overrun of voice communications is heard between selected frequencies simulated by the in... system.

SUT BLUE Forces are not able to hear RED voice communications

SUT RED Forces are not able to hear BLUE voice communication

White Cell/Test Director is able to communicate with SUT at any time during a scenario.

5.3.2 **Tactical Communications/Data Link**

Tactical Data Networking is possible between applicable sites.

## 5.4 Data Collection/Analysis - SIMULIZER Tests

Data Logger is able to receive the Network Loading without system performance loss. (1000 PDUs per second, 8000 Entities being simulated.

Data Logger is able to capture at least 4 hours of simulation play at a time, without any loss of PDU traffic.

Data Logger places Time Stamps on PDUs received (including Voice Comm)

Data Logger is capable of playing back recorded traffic

Logger Playback is capable of changing Site/Application IDs of recorded traffic so that SUT(s) do get confused about receiving "Themselves"

Data Logger is capable of recording all PDU types.

Data Logger is capable of filtering out PDUs that do not match the current Exercise ID of the

If On-line playback is a requirement for Data Analysis, the Data Logger must be capable of the playback data being sent to the Network, by Site, and Field of View.

The Data Logger is capable of logging data with multiple Exercise ID's - remote network traffic as Digital Voice (Note: Digital voice set to ID 100 currently).

**5.5 Simulation Management** For Zen Regard, exercise control shall be communicated through the intercommunication system. Simulation Systems shall need the capability of the following simulation management functions, which will be communicated to them over the intercom system:

SUT has the correct Exercise ID set

SUT is able to Freeze its simulation upon command

SUT is able to Start/Run its simulation upon command

SUT is able to reset to a TBD point in the exercise

## 5.6 Mission Operations

**5.6.1 Command and Control Functions** If a SUT is to act as a Command and Control Structure Scenario, then it must be capable of the following:

SUT is capable of sending Tactical Communications to simulated entities it is scripted to control. (These could be sent via data link, fire transfer, intercom etc.)

SUT is capable of receiving intelligence data from sources identified in the scenario.

5.6.2 **Air Operations** Simulation applications that support air operations shall demonstrate this capability according to what they are scripted to perform in the scenario.

5.6.2.1 **Air to Air Engagements**

SUT entities capable of air-to-air engagements.

5.6.2.2 **Air to Ground Engagements**

SUT is capable of bombing of a target.

SUT is capable of air to surface missile engagements.

5.6.3 **Ground Operations** Simulation applications that support ground operations shall demonstrate this capability according to what they are scripted to perform in the scenario.

5.6.3.1 **Surface to Surface Engagements**

SUT is capable of surface to surface engagements.

5.6.3.2 **Ground to Air Engagements**

SUT is capable of ground to air engagements.

# APPENDIX C TEST PLAN

# DRAFT

**TEST PLAN**

**FOR THE**

**WAR BREAKER SEE DISTRIBUTED SIMULATION**

CONTRACT NO. MDA 972-93-C-0003

MAY 1993

Prepared for:

ARPA

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# WAR BREAKER SIMULATION TEST PLAN

## 1.0. Introduction

The purpose of this document is to define the interoperability requirements of the WAR BREAKER Simulation network.

### 1.1 Types of tests

i) Wide Area Network connectivity
ii) Local static and dynamic tests
iii) Wide Area Static tests
iv) Wide Area Dynamic tests
v) Wide Area Interactive tests
vi) Voice communication tests
vii) Phased scenario tests
viii) Full scenario test

## 2.0 Testing

### 2.1 Wide Area Network Connectivity Tests

This test will provide the basic connectivity testing of each Wide Area Network segment. Testing will be incremental as equipment is installed and security agreements finalized. It will include:

T1 testing from CSU/DSU to CSU/DSU (loop-back test)

KG-94 point-to-point communication (successful keying of two KG-94s)

Bridge/Router to Bridge/Router communication (including WB facility diagnostic capabilities)

Bridge to Bridge communication delay estimates

### 2.2 Local static and dynamic tests

This test will be conducted by all sites with the NPS Stealth World Reference Model capability. This will provide a capability for individual sites to accomplish static and dynamic testing using the same software as the WAR BREAKER facility test standard. Testing procedures will be identical to those contained in Wide Area Static and Dynamic tests described below.

### 2.3 Wide Area Static Tests

Static testing will be accomplished to determine DIS compliance with Entity State PDUs. It will also be used to determine Database correlation between a particular simulation and the database. The system under test (SUT) will be required to locate their entity at selected locations

with a specific orientation. The entity will be viewed on the WB Stealth. Coordinates, heading, and relative location to significant database features will be compared. This procedure will be repeated at a number of locations (What number I don't know) to determine database correlation.

Key entities, such as a TEL, F-15E, Scud missile, and background vehicles (fuel trucks, etc.) will be placed at selected locations to determine the capability of each simulation to correctly process incoming DIS entities.

### 2.3.1 Network Level Tests

### 2.3.2 Coordinated Conversion Comparision Tests

Each site will enter the following locations in the local coordinate system implemented on their SUT:

| | |
|---|---|
| WGS-84: | TBD |
| geocentric: | TBD |
| geodetic: | TBD |
| | |
| WGS-84: | TBD |
| geocentric: | TBD |
| geodetic: | TBD |
| | |
| WGS-84: | TBD |
| geocentric: | TBD |
| geodetic: | TBD |
| | |
| WGS-84: | TBD |
| geocentric: | TBD |
| geodetic: | TBD |
| | |
| WGS-84: | TBD |
| geocentric: | TBD |
| geodetic: | TBD |

Coordinates shall be provided for each SUT in ASCII format. The local coordinates will be run through the SUT's coordinate conversion routine and results compared with the cooresponding WGS-84 coordinates. Coordinate conversions from local coordinates to WGS-84 shall be within +/- 1 cm.

### 2.3.3 Appearance Tests

#### 2.3.3.1 Location Test

#### 2.3.3.2 Attitude Test

## 2.4 Wide Area Dynamic Testing

Wide Area Dynamic testing will further test a simulation's entity state PDU. Entities will be required to start at designated positions and move (drive or fly) on each of the cardinal headings. Their motion will be observed on the stealth to verify correct behavior--speed, orientation, smooth motion, appearance.

In addition, simulations with the capability to launch weapons will be required to release weapons. Weapon flyout will be observed for correct behavior. This will test the fire and detonate PDU.

The dynamic testing will also be used to test the start, stop, and freeze PDUs (simulation management). Each simulation will be required to react properly to start, stop, and freeze PDUs issued from the WB facility.

During individual site dynamic testing with the WAR BREAKER facility, network loading data will be collected for each simulator. Also, the data collection tools at the WAR BREAKER facility and other sites will be tested. Data will be analyzed after test for proper operation by the SAIC and completeness as a system engineering to tool by BAH.

## 2.5 Wide Area Interactive Testing

During Wide Area Interactive testing, one site will network through the WAR BREAKER facility all other sites. The site under test will be scheduled to test with other WAR BREAKER sites individually. Connectivity will be established (bridge to bridge) prior to scheduled test time, and simulation test time with each site will be adhered to. Problems encountered during test will be retested during a subsequently scheduled test period.

These test will be structured to focus on the interaction between simulations not tested during previous test. Simulations transmitting emissions will tested by those simulations will capable of detecting those emissions. Weapons delivery simulations will be tested with their target simulations.

Again during this test, data collection tools operation will be verified by SAIC and validated by BAH.

## 2.6 Voice Communication Tests

Limited voice testing will be accomplished during all phases of testing. The transmit and signal PDU of each site will be tested. Channel selection, frequency, voice quality will be tested. Each operational (by scenario) channel will tested

individually for communication. Communications then will be tested to ensure no bleed through and no communications can be received by simulations restricted from those channels.

### 2.7 Phased Scenario Tests

Phased Scenario testing will test those sites involved in each discrete phase of the Scud hunt scenario. All sites involved in the Wide Area Search phase will be tested. Then the Focused Search, Strike, and BDA phases will be tested.

### 2.8 Full Scenario Test

Full Scenario Testing will differ from Phased Scenario Testing in that all sites will be on line and in their ATO positions waiting for the mission to transition from one phase to the other. Each simulation will react to previous phase realtime results.

# APPENDIX D COMMUNICATIONS PLAN

October 15, 1993

# Zen Regard Communications Plan (By Circuit)

| # | Circuit Name | Frequency | DIS Voice Preset | Entities/Sites |
|---|---|---|---|---|
| D | "Psuedo" Data Link | N/A | N/A | EXCAP, Warrior (TEC), Constant Source (TACCSF), GIST (WBF), ATP (NRaD) |
| J | JTIDS/ TADIL J | N/A | N/A | CRC (TACCSF), AOC-Receive Only (TACCSF), AWACS (TACCSF), Patriot Bde and ICC (TACCSF) |
| P | PADIL | N/A | N/A | Patriot Bde and ICC (TACCSF), Patriot Fire Unit (TACCSF) |
| V1 | Aircraft Control | 238037120 | 1 | All AF A/C (TACCSF, MDA, WL), WBF (EXCAP A/C), AWACS (TACCSF), JSTARS (TACCSF), COBRA BALL (TACCSF), F-18 (Pax River), F-14 (NRaD) |
| V2 | Army Air Surveillance | 238137120 | 2 | GUARDRAIL (WBF/EXCAP), DOCC (TEC) |
| V3 | Air Operations | 238237120 | 3 | AOC (TACCSF), AWACS(TACCSF) |
| V4 | Air Coordination | N/A | N/A | AOC (TACCSF), CRC (TACCSF) |
| V5 | Patriot | 238337120 | 4 | CRC (TACCSF), Patriot Control Battery (WBF) |
| V6 | Army Coordination | 238437120 | 5 | AOC/BCE (TACCSF), DOCC (TEC) |
| V7 | Navy Coordination | 238537120 | 6 | AOC/NCE (TACCSF), MARS (Dahlgren), RESA Remote (Dahlgren), RESA (NRaD), SCIL (APL), OBT-UAV (WBF) |
| V8 | Army Command | 238637120 | 7 | DOCC (TEC), AVTOC (Ft Rucker), AH-64As (Ft Rucker), MLRS Fire Unit (TEC), Mech Team (Ft Knox) |
| V9 | Army JSTARS | 239037120 | N/A | JSTARS/GSM (TEC), DOCC (TEC) |
| V10 | UAV Control | 238737120 | 8 | AOC (TACCSF), HALE-UAV/GCS (WBF), MUSTRS (WBF) |
| V11 | AF JSTARS | 238837120 | 9 | JSTARS (TACCSF), AOC (TACCSF) |

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| # | Circuit Name | Frequency | DIS Voice Preset | Entities/Sites |
|---|---|---|---|---|
| V12 | Control and Reporting | N/A | N/A | AWACS (TACCSF), CRC (TACCSF) |
| V13 | Exercise Control | 238937120 | 10 | WBF, TACCSF, TEC, NRaD, WL, MDA, NTF, Dahlgren, Ft Rucker, Ft Knox, APL, Pax River |
| Default | | 438037120 | None | All Comm Circuits |

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## Zen Regard Communications Plan (By Site)

| Site | Circuits |
|---|---|
| War Breaker | D ("Psuedo" Data Link), V1 (Air Control), V2 (Army Air Surveillance), V5 (Patriot Control), V7 (Navy Control), V10 (UAV Control), V13 (Exercise Control), Also need to monitor all circuits for data collection purposes. Total = 0 Internal Circuits and 13 External Circuits. |
| TACCSF | D ("Psuedo" Data Link), J (JTIDS/TADIL J), P (PADIL), V1 (Air Control), V3 (Air Operations), V4 (Air Coordination), V5 (Patriot Control), V6 (Army Coordination), V7 (Navy Coordination), V10 (UAV Control), V11 (AF JSTARS), V12 (Control and Reporting), V13 (Exercise Control). Total = 4 Internal Circuits and 6 External Circuits. |
| MDA | V1 (Air Control), V13 (Exercise Control). Total = 2 External Circuits. |
| Wright Labs | V1 (Air Control), V13 (Exercise Control). Total = 2 External Circuits. |
| TEC | D ("Psuedo" Data Link), V2 (Army Air Surveillance), V6 (Army Coordination), V8 (Army Command), V9 (Army JSTARS), V13 (Exercise Control). Total = 1 Internal Circuit and 4 External Circuits. |
| NRaD | V1 (Air Control), V7 (Navy Coordination), V13 (Exercise Control). Total = 3 External Circuits. |
| NSWC Dahlgren | V1 (Air Control), V7 (Navy Coordination), V13 (Exercise Control). Total = 3 External Circuits. |
| NTF | V13 (Exercise Control). Total = 1 External Circuits. |
| Ft Rucker | V8 (Army Command), V13 (Exercise Control). Total = 2 External Circuits. |
| Ft Knox | V8 (Army Command), V13 (Exercise Control). Total = 2 External Circuits. |
| APL | V7 (Navy Control), V13 (Exercise Control). Total = 2 External Circuits. |
| Pax River | V1 (Air Control), V7 (Navy Control), V13 (Exercise Control). Total = 3 External Circuits. |

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## Zen Regard Communications Plan - War Breaker Facility

Operations Table:
- Seat 1 through 5 on analog voice circuit channel 1.
- Seat 3 with DIS Voice keypad, with transmit set on preset 10 (Exercise Control), receive set to presets 1 through 10.
- Portable headset set to analog voice circuit channel 1.

Front Table:
- Seat 1 and 2 on analog voice circuit channel 1.

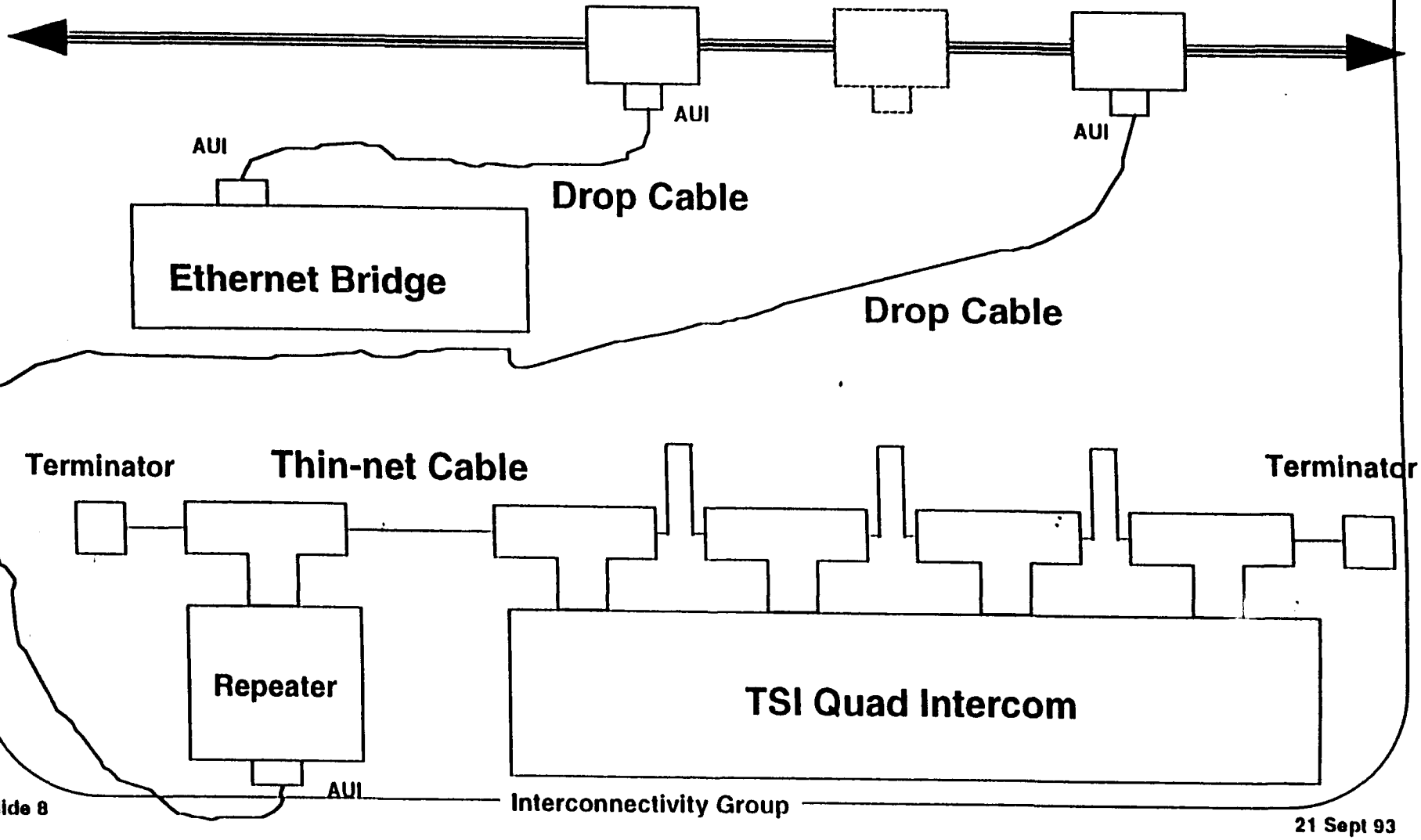
Engineering Pod:
- Aristotle: Receive and transmit set to preset 10 (Exercise Control).
- Bernoulli: Receive and transmit set to preset 10 (Exercise Control).
- Coulomb:
  - LADS SAF: Receive and transmit set to preset 10 (Exercise Control).
  - MARS: Receive set to preset 10 (Exercise Control) and preset 8 (UAV Control), transmit set to preset 8 (UAV Control).
- Portable headset set to analog voice circuit channel 1.

SimCore Pod:
- Descartes: Receive and transmit set to preset 10 (Exercise Control).
- Euclid: Receive set to preset 10 (Exercise Control) and preset 8 (UAV Control), transmit set to preset 8 (UAV Control).
- Faraday: Receive set to preset 10 (Exercise Control) and preset 6 (Navy Control), transmit set to preset 6 (Navy Control).
- Galileo: Receive and transmit set to preset 10 (Exercise Control).
- Portable headset set to analog voice circuit channel 1.

Background Sound System:
- Set to receive preset 1 (Air Control).

# Ethernet Connection
# 10 Base-2 to Thick-net

War Breaker
SEE Team



War Breaker
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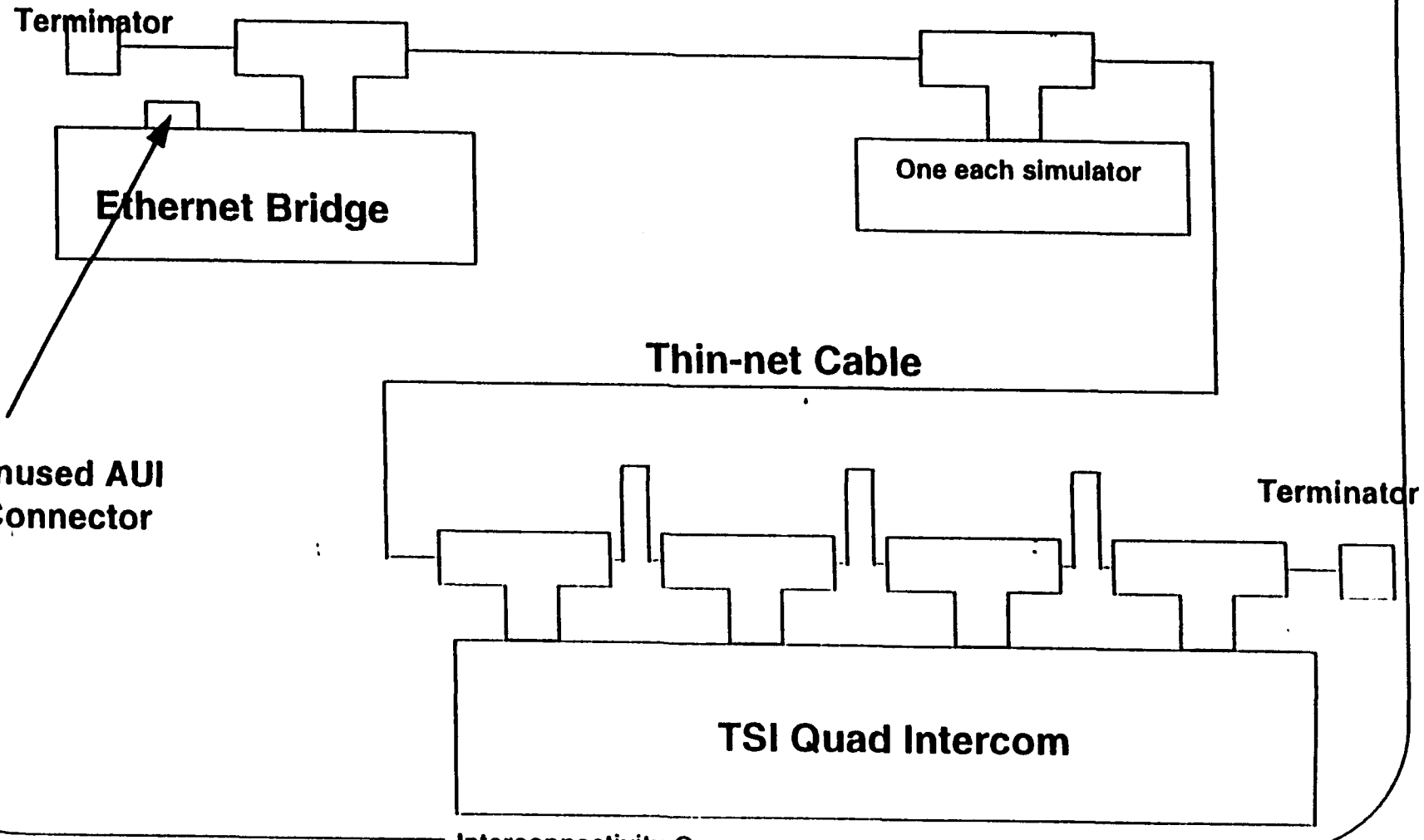
# Ethernet Connection
# 10 Base-2 Configuration